nised students" (formerly "King's scholars"), receiving a grant from the Board of Education, who have matriculated, and are thus qualified to enter one of the schools of the University for a three years' course, leading up to the degree in arts or science. Concurrently with their academic studies they take a course of professional instruction at the training college with a view to certification by the Board. In addition to these students, there is a smaller number of graduates who take a one year's course in preparation for the University's diploma in pedagogy, and intend to teach in secondary schools. Since, however, a rapidly increasing proportion of the recognised students enter with a higher qualification than matriculation, and obtain the degree before the conclusion of the three years' course, the work of the college will in a few years become very largely post-graduate, and may be expected to have an important influence upon the standard of teaching in the elementary schools of London.

Since every student is either a graduate or an internal student of the University in arts or science, the equipment of the college has been determined solely by the needs of the professional side of the course of training. Thus the laboratories, which together with the art studio occupy the top floor of the building, are used almost entirely for the demonstration of methods of teaching science subjects. The larger laboratory (55 feet by 30 feet) contains benches of a special design planned for elementary work in chemistry, physics, and mechanics, fume cupboards, a well-equipped demonstration table, and teak tables used chiefly in connection with the instruction in practical mathematics. Between the mathematical and physical benches accommodation is provided for students following the course of a lesson given to a class of children.

The smaller laboratory (30 feet by 20 feet) is devoted to nature-study. In addition to working benches, it is equipped with specimen cases, a dark cupboard, and other fittings. A balance room and a preparation room situated between the two aboratories serve the needs of both. There is also a small room (readily transformable into a photographic dark room) equipped with water, gas, and electric power, and intended to be used for anthropometric work and for researches in pedagogical psychology.

On the roof, within easy access from the laboratories, is a plant house containing a large tank for aquatic plants and animals. The level space around this is utilised as a meteorological observatory in connection with lessons in geography. Finally, on the floor below that already described, is a pedagogical museum, which performs the functions of a geographical laboratory.

Carefully planned and closely correlated courses in mathematics, geography, nature-study, and physical science are taught in these laboratories to the children of the demonstration schools by students under supervision. Most of these students either have already graduated or are about to sit for the B.Sc. degree, and are paying special attention during their last year to the teaching of the scientific subjects of the curriculum.

IMMUNITY TO DISEASE AMONG PLANTS.[1]

THE question of immunity to disease has been so closely studied and so frequently discussed in connection with the diseases of man that it seemed to me that it might be of interest to bring together some of the facts now known to us about the incidence of disease among plants and the theories which have been advanced as to the cause of the immunity which some species and varieties exhibit to various diseases.

The late Prof. Marshall Ward has shown that *Puccinia dispersa*, the brown rust of grasses, seems to exist in several "biologic forms," each of which attacks only one group of nearly related species of Bromus, and the same condition obtains in the Erisipheæ, or mildews, according to Salmon. How is it that these fungi are incapable of infecting such nearly related host plants as are represented by the species within a single genus? The suggestion was originally made that differences in the thickness of the cell walls, fewer or smaller stomata, longer hairs, &c., were the obstacles which repelled the fungi and rendered certain species and genera of plants immune to the attacks of particular fungi. Working with the different species of Brome, Marshall Ward was, however, able to show that there was no relationship between the stomata, hairs, and so forth, and the infectibility of the species. Immunity did not in any way depend upon the anatomical characters of the host plant, but entirely on physiological reactions of the protoplasm of the fungus and of the cells of the host. In other words, infection and resistance to infection depend on the power of the fungus protoplasm to overcome the resistance of the cells of the host by means of enzymes or toxins, and reciprocally on the protoplasm of the cells of the host to form anti-bodies which destroy such enzymes or toxins, just as is the case with resistance of animal organisms to their bacterial foes. Salmon has shown in his experiments that susceptibility in a leaf normally immune to the attacks of the biologic form of a particular mildew may be induced by various mechanical means, such as cutting the leaf or searing it with a red-hot point of a knife, or by exposing the leaf to ether or alcohol vapours, or by exposing it to heat. The resistant vitality is thereby impaired, and the fungus gains the upper hand. Plants, if not immune to a particular disease, may be rendered so to a certain extent by similar methods to those employed in the case of animals. More or less successful injection experiments have been made in the case of fruit trees suffering from chlorosis, and as a result animal parasites have been got rid of as well. Undoubtedly if the general vitality of the tree can be raised some diseases can be thrown off.

Marchal has stated, 1902, that young plants of the lettuce could be rendered immune against *Bremia latucae* by feeding the plants with a solution of copper sulphate (1 in 30,000). This view has received support from Laurent and Massée, but Salmon has not been able to confirm these results. It will be seen that the views are still somewhat conflicting, and too much must not be expected from such methods of treatment.

The hope of the agriculturist lies in another direction. Plants, like animals, are subject, as Darwin has shown, to a considerable amount of variation, and all characters, whether anatomical or physiological, are subject to change or mutation. Immunity to disease, dependent as it is on certain physiological peculiarities, the secretion of anti-toxins, rather than on anatomical structure, is similarly a subject of variation. We see this readily illustrated when passing through a field exposed to some epidemic disease, where here and there plants are found which have been either only slightly damaged or not attacked at all. These should be selected for breeding purposes, and thus hardier varieties can be produced. Another method which has shown itself useful for producing resistant forms is by hybridising. It is a well-known fact that hybrids, while partaking of the nature of one or both of the parents in most characters, generally exceed both in vegetative vigour—a characteristic to which the sterility of some hybrids is attributed. But vegetative vigour, as we have seen above, is generally associated with immunity to disease, and hence hybrids are often found to be more resistant. This is not always the case, for in this respect hybrids vary too, but the French horticulturists MM. Bouttes and Guillon have been successful in producing hybrid vines which are more resistant to the mildew than either of the parents.

In the selection of immune varieties one is faced with the unfortunate fact that many of the most resistant forms are the least valuable, producing poorer fruits and seeds than the delicate forms. But by judicious hybridising this defect of the immune race can be largely counteracted. Mr. Lewton Brain has collected a good deal of information on this point. Both in the case of vines and in wheat many disease-resisting forms have been produced.

In connection with cotton crops, it is remarkable how great is the range of variation with regard to the resistance of the plants to the wilt disease (*Neocosmospora vasinfecta*). By selection and suitable hybridising, Rivers has been able to obtain varieties which remained untouched by the disease, while of the neighbouring crops

[1] Abridged from an address delivered at the annual meeting of the British Pharmaceutical Conference at Manchester by Prof. F. E. Weiss.

95 per cent. were destroyed. In the West Indies the Bourbon cane has been given up on account of disease, but very useful and disease-resisting hybrids have been produced by crossing the valuable but easily attacked Tjeribon cane with the resistant Indian Tschan cane.

It will thus be seen that breeders have the power by careful selection to combine disease-resisting powers with relatively great fertility, and therein lies our hope for the future success of agriculture.

THE BED OF THE WESTERN PACIFIC OCEAN.

THE results of surveys carried out by the surveying vessel *Edi* and the cable-ship *Stephan* during 1903 and 1905 in the western and south-western parts of the Pacific Ocean have been published in a paper by Drs. G. Schott and P. Perlewitz, recently issued in the *Archiv der deutschen Seewarte*. An abstract by Dr. Schott appears in the *Annalen der Hydrographie* (1907, p. 108). Taken in conjunction with the work of the American vessel *Nero* (already noticed in these columns) and of the German vessel S.M.S. *Planet* (see *Annalen der Hydrographie*, 1907, pp. 49 and 50, 193 and 194, and 196), these soundings throw a great deal of new light on the configuration of the sea bottom in those regions, disclosing certain characteristic features of great interest in their bearing on the history of the Pacific Ocean and its extension westward at the expense of the Asiatic continent, and also on the general problem of the form of the surface of the lithosphere.

The typical form may be described thus. Along a line running seaward from the coast of Asia the depth is (beyond the continental shelf) about 3000 metres; it diminishes slowly and fairly uniformly at first, then rapidly, until the surface is reached on a cross-line of islands. To seaward of the islands the bottom falls first slowly and then very steeply to a line of "deeps," in which depths of 7000 metres to 9000 metres are reached; then follows a fairly gradual rise to a "Horst" some 4000 metres below the surface. These structures, so far as appears from these observations, occur (1) in the Liu-Kiu Islands and deep; (2) in the Tulur Islands and deep; and (3) in a line following the Pelew Islands, Yap, Guam, and the eastern Ladrones. The soundings of the *Planet* show that the "Tulur" deep (2) is continuous with a long, narrow trough extending northward along the east coast of the Philippines, and it seems not unlikely that the "Liu-Kiu" deep (1) is part of the same depression. The "Guam" deep is identical with the "Caroline" deep discovered by Friederichsen in 1901.

The troughs forming the deeps are usually about ten miles wide (the Guam deep is as much as twenty miles across), and Drs. Schott and Perlewitz are of opinion that they are the result of subsidence occurring on an enormous scale along lines of fracture. It is probable that the disturbances which produced these structures are comparatively recent; geological relations suggest Tertiary times, at least in the case of the Liu-Kiu deep, and there is obviously nothing in the suggestion incompatible with the great antiquity of the Pacific basin as a whole.

HYDROLOGY IN EGYPT.

"THE Rains of the Nile Basin and the Nile Flood of 1906" is the first of a new series of periodical reports which are being published by the Survey Department of Egypt. These departmental papers are intended to comprise results of technical or scientific interest which are obtained in the course of the work of the department.

Captain H. G. Lyons, the director, says that although the increase of rainfall stations in British Central Africa, Uganda, and the Sudan has materially reduced the difficulty of forecasting the flood, the absence of any definite information as to the meteorological conditions of Abyssinia, especially during the rainy season, June to August, is a great drawback, and to overcome this somewhat he intended early in 1907 to send a qualified meteorologist to Addis Abbaba to study the local conditions.

The chapter on the normal distribution of rainfall traces the heavy rains from Zomba and British Central Africa and German East Africa in January and February to Abyssinia and the Sudan in July and August. During these two months these countries receive 60 per cent. of their annual rainfall. In September the rain begins to moderate in Abyssinia, and to retreat southwards.

In discussing the rainfall for 1906, it is shown that most places in the districts under observation had excess rain at the period of normally heavy rains, whilst in their respective dry seasons there was deficiency. In the Nile Basin the rains were somewhat late in commencing.

At the end of October, 1905, it seemed likely that during 1906 the Nile would be low, for the summer rains in Abyssinia had been weak. In November, February, and March some exceptional and heavy rains improved matters, and gave a fairly good supply of water.

At Khartoum the flood commenced on May 27, sixteen days late, and reached its maximum on September 14, ten days late. The volume of the flood estimated from the discharge curve of the Aswan gauge during July, August, September, and October was 0·87 of the mean of thirty-eight years.

During April, 1906, Mr. J. I. Craig made an investigation to determine the amount of seepage through the banks of the river. Using the records of flow at Aswan and Sarras, and special observations of flow made at Kareima, Mr. Craig came to the conclusion that at the period of low water, and on that stretch of the river between Khartoum and Sarras, a distance of 1480 kilometres, water flowed through the banks into the river at the rate of between 140 and 200 cubic metres per second. During the flood water passes out of the river similarly, for then the level of the water-table in the surrounding country is lower than the surface of the river.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Sites Syndicate has had under consideration the most suitable position for the proposed buildings in connection with the school of agriculture. It is of opinion that the most suitable position would be one on the Downing site, to the south of the botany school and parallel with it. The building on this site would be near the departments of botany and geology, and would be accessible from three roads, and it would be well lighted. At the present time the department of agriculture is housed in the basement of the chemical laboratory, but in view of the greatly increasing number of students in agriculture proper provision of laboratories, lecture-room, and museums is urgently needed. Towards the cost of an agricultural school some 13,000*l.* has already been subscribed by friends of agriculture and the University. A suitable building would probably cost some 20,000*l.*, and it is further desirable that some provision should be made for maintenance.

Mr. A. E. Shipley has been nominated a manager of the Frederick James Quick fund from January 1, 1908, to December 31, 1913.

The following have been nominated examiners for the Natural Sciences Tripos in 1908:—*Physics*, Mr. J. A. McClelland and Mr. P. V. Bevan; *chemistry*, Dr. Fenton and Mr. K. J. P. Orton; *mineralogy*, Mr. A. Hutchinson and Mr. L. J. Spencer; *human anatomy*, Mr. T. Manners-Smith and Prof. R. Howden; *geology*, Mr. E. J. Garwood and Mr. W. G. Fearnsides; *botany*, Mr. F. W. Oliver and Mr. F. F. Blackman; *zoology*, Dr. Harmer and Mr. R. C. Punnett; *physiology*, Mr. F. G. Hopkins and Dr. M. S. Pembrey.

OXFORD.—The preamble of a statute establishing a professorship of engineering science was passed by Congregation on October 29 by a majority of 152 to 20.

The Burdett-Coutts scholarship in geology has been awarded to R. L. Robinson, Magdalen College; C. H. Dinham, Magdalen College, distinguished himself in the examination.

LORD AVEBURY has been elected without opposition Lord Rector of the University of St. Andrews.